THE SOURDOUGH SCHOOL

Phytochemicals in Wholegrain Bread

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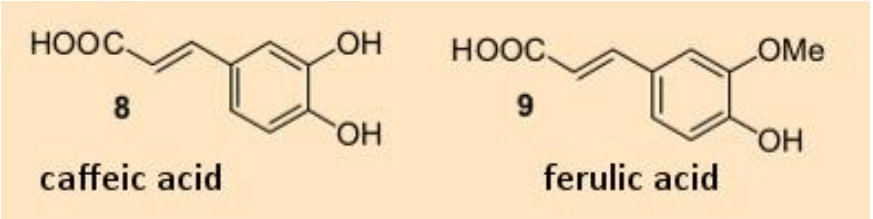
What is a Phytochemical?...

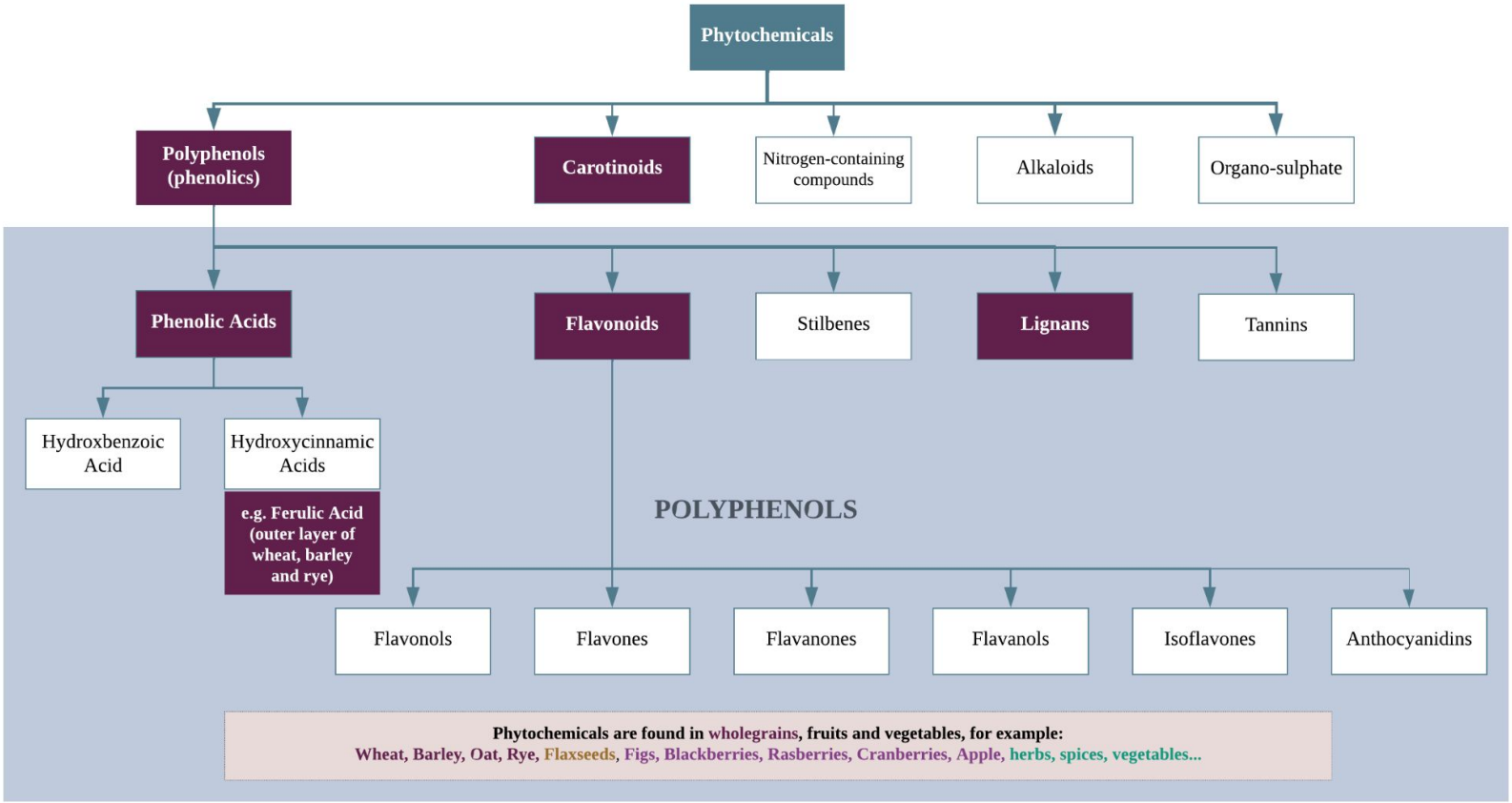


- ★ Phytochemicals represent various bioactive components within a plant, including within wholegrains
- ★ Phytochemicals are designed in structure (as above - phenol rings with OH groups) to help plants grow, protecting them from pathogens and predators
- ★ As a result, when we ingest the plants and grains, these bioactive compounds behave as antioxidants (see No.4 of our 7 Core Principles)
- ★ Antioxidants are designed to scavenge free radicals, the highly reactive molecules produced from toxic insults and the everyday metabolism of our cells
- ★ What's more, studies do suggest that some of the phytochemicals modulate the production and gene expression of pro-inflammatory molecules, supporting our immune system

Source: Nikolai Kuhnert 2017; Bellik et al. 2013

Family tree of phytochemicals...

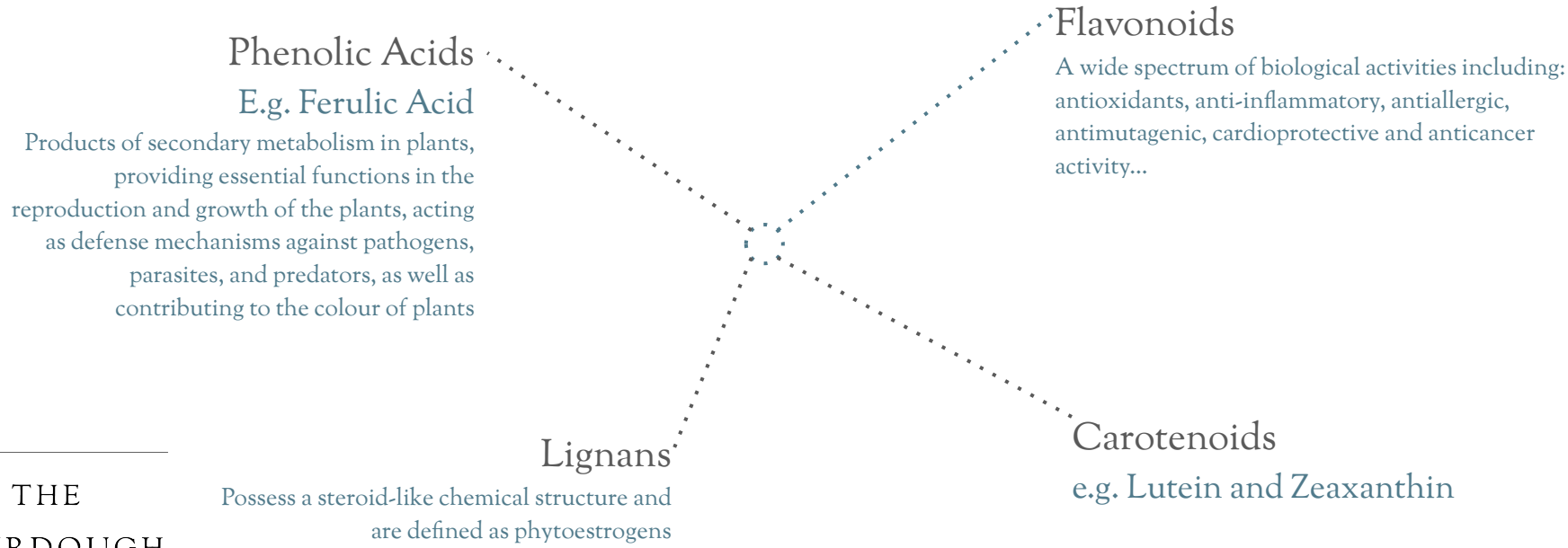
= Found in Wholegrains



Source: Adapted from Bellik et al. 2013

What are the main phytochemicals in wholegrains?

These bioactive molecules include phenolic compounds, representing a whole family of 'Polyphenols'...



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The most abundant phenolic compound in the grain: Ferulic Acid...

Health Benefits of the phytochemicals in wheat according to the research...

Immune strengthening, anti-inflammatory:
E.g. Invivo (animal) studies find flavonoids, found in wholegrains, dampen the expression of NF-kβ (the main inflammatory cytokine)

Gut Microbiome and flavonoids:
Inflammatory molecules, such as NF-kβ, drive dysbiosis (imbalance of gut microbes) and we know that polyphenols are known to feed the good bacteria (prebiotics)

Lower risk of Alzheimer's and Ferulic Acid?
Animal and laboratory studies suggest that the antioxidant nature of Ferulic acid can support mechanisms to reduce the risk of Alzheimer's disease.

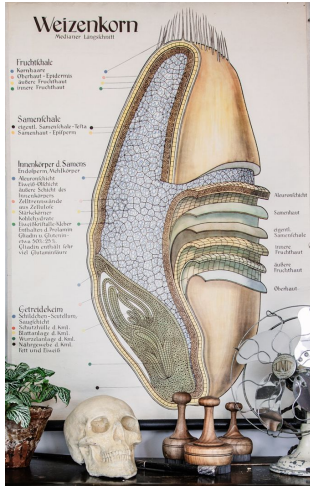
Lower risk of cancer and wholegrains:
E.g. Observational human studies find that the consumption of wholegrains is associated with lower risk of cancer. By what mechanism? Fibre or phytochemicals...

Lower risk of CVD and flavonoids:
E.g. A human study of nearly 100,000 men and women of around 70 yrs find that a higher level of flavonoid intake was associated with lower risk of CVD.

Eye health and Lutein:
Macular Pigment (MP) protect the eyes by absorbing the damaging blue light and human studies find that dietary Lutein, found in wholegrains, increases levels of MP

Source: Muto et al 2020; Graydon R et al. 2012; McCollough ML et al 2012; Gaesser 2020; Sgarbossa et al 2015

Where in the grain and how do we absorb them?...



Where are these located in whole grains?
These bioactive compounds are located in the percap seed coat, the aleurone layer and the bran/germ of the grain. Given their functionality, many more are found in the outer layers of course...

The content of phytochemicals in the grain will depend on cultivars and the environment to which they are grown in:
Vanessa's theory: phenolics change the germination rate and therefore for mass production, they have been lowered in modern grains, and this is why grains so blonde!

Vanessa's reverse engineering mission in her systems change programme here at the Sourdough School is to breed these phenolics back in: Putting black grains into botanical blends...

Absorption and biotransformation:
Invivo (rats) studies find that these free phenolic acids can be absorbed by the monocarboxylic acid transporters (MCT) in the gastrointestinal mucosa

Studies also suggest the metabolism of ferulic acid itself is performed by enzymes produced by LAB with the GI tract

Source: Konishi et al 2006; Szwajgier D et al 2010

A Game Changer: Fermentation, Diversity and Symbiotic Eating

Our Core Principle No. 3: Fermentation

As we know, the phytochemicals such as ferulic acid, are bound in cell structure of the grain
Fermentation promotes acidity and enzymes that break down these the cell structures:
making phytochemicals more bioavailable

Our Core Principle No. 2: Diversity

The botanical blends here at the Sourdough School are about the **diversity score**, a rating to asses the range of phytochemicals in a recipe (**red** = lycopenes; **greens** = flavonoids; **blue** = anthocyanins ; **yellow** = carotenoid)

Eat the Rainbow in and on your bread, to further boost your levels of phytochemical intake

The Eating Symbiotically Pyramid

Eating in synergy with yourself ('one size does not suit all'), your community and your planet

Source: Minich 2019; The Sourdough School Sweet Baking

To conclude...

- ★ Phytochemicals are gained from plants, including wholegrains and provide us with protection from oxidants and provide anti-inflammatory support through various mechanisms
- ★ The main phytochemicals in wholegrains are: Phenolic acids, Flavonoids, Lignans and Carotenoids
- ★ Human studies find these phytochemicals can protect our eyes and lower our risk of CVD and Cancer
- ★ Animal studies find that they may well also strongly support our immune system, gut microbiome health and reduce our risk of Alzheimer's disease
- ★ The best way to get enough phytochemicals in our diet to support our health is to follow our core principles and enjoy your bread by eating symbiotically

Thank you for listening!

References - Bibliography

Nikolai Kuhnert 2017

Bellik et al. 2013

Konishi et al 2006

Gaesser 2020

Mutoh et al 2020

Graydon R et al 2012

Sgarbossa et al 2015